MISSION SUPPORT

FISCAL YEAR 2001 ESTIMATES

BUDGET SUMMARY

OFFICE OF MANAGEMENT SYSTEMS **CONSTRUCTION OF FACILITIES**

SUMMARY OF RESOURCES BY APPROPRIATION

	FY 1999 OPLAN 12/23/99	FY 2000 OPLAN REVISED	FY 2001 PRES BUDGET	Page Number
		(Thousands of Dollars)		
Human Space Flight Appropriation	17,800	13,200	16,300	MS 4-8
Science, Aeronautics and Technology Appropriation	19,500	24,200	37,500	MS 4-11
Mission Support Appropriations	168,500	181,900	245,900	MS 4-17
Total	205,800	219,300	299,700	

PROGRAM GOALS

The goal of the Construction of Facilities program is to ensure that the facilities critical to achieving NASA's space and aeronautics program are constructed and continue to function effectively, efficiently, and safely, and that NASA installations conform with requirements and initiatives for the protection of the environment and human health.

STRATEGY FOR ACHIEVING GOALS

NASA facilities are critical the shuttle, to sustaining payload and launch operations, and for providing critical national aeronautical and aerospace testing capabilities, which both support military and private industry users. NASA has conducted a thorough review of its facilities infrastructure finding that the that deteriorating plant condition warrants an increased repair and renovation rate to avoid safety hazards to personnel, facilities, and mission; and that some dilapidated facilities need to be replaced. Increased investment in facility revitalization is needed to maintain a facility infrastructure that is safe and capable of supporting NASA's missions. The Budget supports increased facilities funding to address these needs.

The Construction of Facilities (CoF) budget line item in the Mission Support appropriation provides for discrete projects required for components of the basic infrastructure and institutional facilities. Almost all of these projects are capital repair. The Mission

Support appropriation also includes Minor Revitalization and Construction projects (projects greater than $500 thousand but not over $1.5 million), the design of facilities projects, and advanced planning related to future facilities needs. Funding for construction projects required to conduct specific Human Space Flight or Science, Aeronautics, and Technology programs or projects is included in the appropriate budget line item. Descriptions and cost estimates are shown as part of the Construction of Facilities program to provide a complete picture of NASA's budget requirement for facilities.

Within the Human Space Flight appropriations account, the Space Flight Operations (Space Shuttle) FY 2001 budget request includes Discrete projects to restore the wall and ceiling integrity of the Payload Changeout Room of Pad B at Kennedy Space Center and repair and upgrade Substations 20A/20B for the Vertical Assembly Building at the Michoud Assembly Facility. It also includes minor projects less than $1,500,000 required to support specific programs. The Science, Aeronautics, and Technology appropriations account includes budget requests for Discrete projects in Aero-Space Technology, to replace the fan blades in the National Full-scale Aerodynamic Complex at Ames Research Center and to construct a Rocket-Based Combined Cycle Test Facility at the Stennis Space Center; in Space Sciences, to construct a Laboratory for In-Situ Microbiology at Jet Propulsion Laboratory; and in Life and Microgravity Sciences and Applications, to continue construction of the Booster Application Facility at Brookhaven National Laboratory.

Mission Support funding is requested in FY 2001 for discrete projects to repair and modernize deteriorating and obsolete building and utility systems that have reached or exceeded their normal design life, are no longer operating effectively or efficiently, and cannot be economically maintained. These systems include mechanical, structural, cooling, steam, electrical distribution, sewer, and storm drainage at Ames Research Center, Glenn Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Johnson Space Center, Kennedy Space Center, Marshall Space Flight Center, Michoud Assembly Facility, and Wallops Flight Facility. Also included is a project to upgrade the 34-meter beam wave-guide antenna subnet of the Deep Space Network for Ka-band operation and three projects to replace old dilapidated trailers and boxcars with new facilities at Kennedy Space Center. Should residual resources become available from these projects, they will be used for urgently needed facility revitalization requirements. Congress will be notified before work is initiated for any such project that exceeds $1,500,000.

The Minor Revitalization and Construction program included in this request continues the vital rehabilitation, modification, and repair of facilities to renew and help preserve and enhance the capabilities and usefulness of existing facilities and ensure the safe, economical, and efficient use of the NASA physical plant. The Minor Revitalization and Construction program also replaces substandard facilities in cases where it is more economical to demolish and rebuild than it is to restore. In selected cases, additional square footage may be built when there are compelling reasons to support new or specialized technical and/or institutional requirements of a nature that cannot be provided by using existing facilities.

Funds requested for Facility Planning and Design cover advance planning and design requirements for potential future projects, preparation of facility project design drawings and bid specifications, master planning, facilities studies, and engineering reports

and studies. Also included are critical functional leadership activities directed at increasing the rate of return of constrained Agency resources while keeping the facility infrastructure safe, reliable, and available.

The Mission Support Appropriation also includes the Environmental Compliance and Restoration (ECR) Program which is critical to ensuring that statutory and regulatory environmental requirements and standards are met. NASA's environmental strategy demonstrates our commitment to protect the environment and provides for the protection and safety of human health. This commitment is achieved by focusing and directing our leadership and efforts into the principal areas of environmental compliance, remediation, restoration and conservation, and prevention. The requested funds cover environmental activities required for compliance with environmental statutory and regulatory requirements and standards, orders, regulatory and cooperative agreements and support of environmental program initiatives.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 2001 ESTIMATES

SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT

INSTALLATION AND PROJECT	FY 1999 OPLAN 12/23/99	FY 2000 OPLAN REVISED	FY 2001 PRES BUDGET	Page Number
		(Thousands of Dollars)		
HUMAN SPACE FLIGHT	17,800	13,200	16,300	
INTERNATIONAL SPACE STATION	1,200	---	---	
Modifications for Electrical Power Upgrades, Building 30S (JSC)	1,200	---	---	
SPACE FLIGHT OPERATIONS (SPACE SHUTTLE)	13,500	11,000	15,500	
Repair Payload Changeout Room, Pad B (KSC)	---	---	2,300	MS 4-9
Repair and Upgrade Substations 20A/20B (MAF)	---	---	1,800	MS 4-10
Refurbish Elevator Controls, Vehicle Assembly Building (KSC)	---	2,300	---	
Restore Pad Surfaces and Slopes, Pad B (KSC)	---	1,800	---	
Rehabilitate 480V Electrical Distribution System, ET Manufacturing Bldg. (MAF)	2,000	1,800	---	
Construct Safe Haven, LC 39 (KSC)	5,900	---	---	
Refurbish Pad A Fixed Support Structure Elevator System (KSC)	2,300	---	---	
Refurbish Pad A Flame Deflector and Trench (KSC)	1,500	---	---	
Repairs to Cleaning Cell E, Vertical Assembly Building (MAF)	1,800	---	---	
Minor Revitalization and Construction of Facilities at Various Locations, Not in excess of $1,500,000 per project	---	2,400	8,600	MS 4-38
Facility Planning and Design	---	2,700	2,800	
PAYLOAD AND ELV SUPPORT	3,100	2,200	800	
Rehabilitate and Modify Launch Vehicle Data Center, Hangar AE, Cape Canaveral Air Station (CCAS) (KSC)	700	---	---	
Replace Backup Power Supply System, VAFB, SLC-2 (KSC)	900	---	---	
Rehabilitate E&O Building, CCAS (KSC)	1,500	---	---	
Minor Revitalization and Construction of Facilities at Various Locations, Not in excess of $1,500,000 per project	---	2,200	800	MS 4-38

CONSTRUCTION OF FACILITIES

FISCAL YEAR 2001 ESTIMATES

SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT

INSTALLATION AND PROJECT	FY 1999 OPLAN 12/23/99	FY 2000 OPLAN REVISED	FY 2001 PRES BUDGET	Page Number
		(Thousands of Dollars)		
SCIENCE, AERONAUTICS, AND TECHNOLOGY	19,500	24,200	37,500	
SPACE SCIENCE	12,000	2,500	13,000	
Construct Laboratory for In-Situ Microbiology (JPL)	---	---	13,000	MS 4-12
Construct Optical Interferometry Development Laboratory (JPL)	2,500	2,500	---	
Modification of Stratospheric Observatory for Infrared Astronomy (SOFIA) Ground Support Facility (ARC)	7,000	---	---	
Restore Meteorological Development Laboratory (GSFC)	2,500	---	---	
LIFE AND MICROGRAVITY SCIENCE AND APPLICATIONS	3,500	9,000	8,500	
Construct Booster Applications Facility, Brookhaven National Laboratory, Phase 4	3,500	9,000	8,500	MS 4-13
EARTH SCIENCE	1,500	1,000	---	
Restore Meteorological Development Laboratory (GSFC)	1,500	1,000	---	
AERO-SPACE TECHNOLOGY	2,500	11,700	16,000	
Replace Fan Blades, National Full-scale Aerodynamic Complex, Phase 3 (ARC)	2,000	3,400	6,000	MS 4-15
Construct Rocket-Based Combined Cycle (RBCC) Test Facility (SSC)	---	1,000	10,000	MS 4-16
Replace Main Drive for 14x22-Foot Subsonic Tunnel (LaRC)	500	7,300	---	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 2001 ESTIMATES

SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT

INSTALLATION AND PROJECT	FY 1999 OPLAN 12/23/99	FY 2000 OPLAN REVISED	FY 2001 PRES BUDGET	Page Number
MISSION SUPPORT CONSTRUCTION OF FACILITIES (COF)		(Thousands of Dollars)		
Restore Electrical Distribution System (ARC)	2,200	2,700	9,000	MS 4-18
Provide 34.5kV Alternate Feed to Substation G (GRC)	---	---	4,500	MS 4-19
Rehabilitate Distributed Control System (GRC)	---	---	3,000	MS 4-20
Repair Sanitary Sewer System (GRC)	---	---	4,400	MS 4-21
Repair Site Steam Distribution System (GSFC)	2,000	2,900	4,000	MS 4-22
Restore Chilled Water Distribution System (GSFC)	---	3,900	5,000	MS 4-23
Replace Chillers, Space Flight Operations Facility (JPL)	---	---	1,800	MS 4-24
Upgrade 34-Meter Beam Waveguide Antenna Subnet for KA-Band, Network (JPL)	---	---	1,900	MS 4-25
Rehabilitate Electrical Distribution System, 200 Area, WSTF (JSC)	---	---	2,500	MS 4-26
Construct Operations Support Building, Hypergol Maintenance Facility (KSC)	---	---	3,300	MS 4-27
Construct Operations Support Building, Pad B (KSC)	---	---	4,000	MS 4-28
Construct Operations Support Building II, LC-39 Area (KSC)	---	---	13,000	MS 4-29
Repairs to Primary Electrical Power System, (KSC)	---	---	3,500	MS 4-31
Repairs to Electrical Systems, East and West Areas (LaRC)	---	---	9,000	MS 4-32
Repair and Modernize Fluid Dynamics Vacuum Pump Facility (MSFC)	---	---	2,600	MS 4-33
Replace Roof, Building 4705 (MSFC)	---	---	2,400	MS 4-34
Replace Mechanical Equipment and Roof, Building 350 (MAF)	---	---	5,800	MS 4-35
Repair Storm Drainage System (WFF)	---	---	2,700	MS 4-36
Rehabilitate Hangar, Building 4802 (DFRC)	---	2,900	---	
Rehabilitate High Voltage System (GRC)	8,300	7,600	---	
Upgrade 70M Antenna Servo Drive, 70M Antenna Subnet (JPL)	---	3,400	---	
Rehabilitate Utility Tunnel Structure and Systems (JSC)	---	5,600	---	
Connect KSC to CCAS Wastewater Treatment Plant (KSC)	---	2,500	---	
Rehabilitate High Pressure Storage System, LC-39 (KSC)	---	3,400	---	
Replace High Voltage Load Break Switches (KSC)	---	1,400	---	
Repair Roofs, Vehicle Component Supply Buildings (MAF)	---	2,000	---	
Replace Air Storage Field, 8-FT High Temperature Tunnel (LaRC)	---	10,000	---	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 2001 ESTIMATES

SUMMARY OF BUDGET PLAN BY APPROPRIATION AND PROJECT

INSTALLATION AND PROJECT	FY 1999 OPLAN 12/23/99	FY 2000 OPLAN REVISED	FY 2001 PRES BUDGET	Page Number
		(Thousands of Dollars)		
MISSION SUPPORT COF (Continued)				
Modernization of Process Cooling System, Numerical Aerodynamic Simulation Facility (ARC)	2,700	---	---	
Contractor Claim on Project to Construct Integrated Test Facility (DFRC)	2,000	---	---	
Restoration of Space/Terrestrial Application Facility (GSFC)	5,000	---	---	
Construction of In-Situ Instruments Laboratory (JPL)	5,000	---	---	
Replacement of Central Plant Chilled Water Equipment (JSC)	5,200	---	---	
Upgrade of Utility Annex Chilled Water Plant (KSC)	1,900	---	---	
Rehabilitation of Instrument Research Laboratory (LARC)	3,100	---	---	
Modification of Chilled Water System (MSFC)	7,200	---	---	
Construction of Addition to Administration Building (SSC)	1,500	---	---	
Minor Revitalization and Construction of Facilities at Various Locations, Not in excess of $1,500,000 per project	68,400	79,300	106,800	MS 4-38
Facility Planning and Design	14,000	14,200	15,700	MS 4-43
Environmental Compliance and Restoration	40,000	40,100	41,000	MS 4-46
Total - Mission Support	168,500	181,900	245,900	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 2001 ESTIMATES

SUMMARY

HUMAN SPACE FLIGHT

	Amount (Thousands)	Page Number
Space Flight Operations (Space Shuttle):		
Repair Payload Changeout Room, Pad B (KSC)	2,300	MS 4-9
Repair and Upgrade Substations 20A/20B (MAF)	1,800	MS 4-10
Minor Revitalization of Facilities at Various Locations, Not in excess of $1,500,000 per project	8,600	MS 4-38
Facility Planning and Design	2,800	
Payload and ELV Support:		
Minor Revitalization of Facilities at Various Locations, Not in excess of $1,500,000 per project	800	MS 4-38
Total Human Space Flight	16,300	

PROJECT TITLE: Repair Payload Changeout Room, Pad B
COGNIZANT OFFICE: Office of Space Flight

INSTALLATION: Kennedy Space Center
LOCATION: Brevard County, Merritt Island, FL

FY 01 COST ESTIMATE (Thousands of Dollars):	2,300
Project Element:	
Civil and Structural	1,900
Mechanical	200
Electrical	200

PRIOR YEARS FUNDING:	107,684
Construction	---
Facility Planning and Design	184
Capitalized Investment	107,500

PROJECT DESCRIPTION:
This project replaces damaged Payload Changeout Room (PCR) wall panels, replaces or eliminates various leaking access doors, replaces the ceiling grid assembly, and illuminates the access area within the PCR plenum. The high efficiency particulate air (HEPA) filter housing will be reconfigured to allow safer accessibility.

PROJECT JUSTIFICATION:
The Launch Complex 39 Pad B PCR was built in circa 1976 to provide a pressurized, contaminant-free environment for pre-flight servicing of Space Shuttle hardware. However, the PCR can no longer be pressurized because of structural and mechanical defects in exterior walls and access doors caused by severe weather-related damage and prolonged deterioration. As a result, contamination levels within the PCR have increased alarmingly. Friable insulation associated with mechanical components also contributes to the contamination. Current conditions will soon cause the payload-processing environment to exceed acceptable limits for contamination and pressurization capability and therefore become a launch constraint. This project replaces damaged structures that allow contaminants to enter the PCR's controlled space. Project completion is essential to avoid costly launch delays that would occur if the PCR lost its capability to maintain a controlled environment.

This project was originally in the FY 2000 budget but was deferred to accommodate an urgent safety project when the launch window required to accomplish the project moved due to changes in the Shuttle launch manifest. The urgent safety project substituted in its place repairs the elevator controls in the Vehicle Assembly Building.

IMPACT OF DELAY:
Repairs to the PCR can no longer be operationally deferred. Failure to repair the PCR structure and supporting mechanical systems would risk exposure of Space Shuttle hardware to contamination levels that exceed acceptable limits. This would hinder Space Shuttle launch preparation and cause costly launch delays. Operations and maintenance costs associated with keeping the deteriorated structure and mechanical components would continue to increase.

PROJECT TITLE: Repair and Upgrade Substations 20A/20B
COGNIZANT OFFICE: Office of Space Flight

INSTALLATION: Michoud Assembly Facility
LOCATION: New Orleans, Orleans Parish, LA

FY 01 COST ESTIMATE (Thousands of Dollars):	1,800
Project Element:	
Site Preparation and Demolition	265
Switchgear and Breakers	525
Motor Control Centers, Switchboards, and FDR Sections	400
Enclosure with Bus Duct	175
Wires and Cable Terminations	250
Miscellaneous Fittings and Components	185

PRIOR YEARS FUNDING:	312
Construction	---
Facility Planning and Design	140
Capitalized Investment	172

PROJECT DESCRIPTION:
This project repairs and upgrades the main electrical distribution system servicing the Vertical Assembly Building (110) and the Mix Room Building (130). The project includes replacement of switchgear, 480-volt feeders, motor control centers, 480/277-volt power panels, switchboards, bus duct, transfer switches, 13.8-kilovolt switches, and other related electrical components.

PROJECT JUSTIFICATION:
The transformers in Substation 20A/20B were replaced in 1986, but all remaining components have not been replaced since the substation was built in 1963. Substation components exceed design life expectancy. Breakers and other spare parts are difficult and costly to obtain in a timely matter because they are no longer in production and require custom fabrication. The substation has experienced widespread deterioration of the feeder insulation, 480-volt panels, and motor control centers. Non-grounded bus duct is utilized throughout the system posing a safety hazard.

Substation 20A/20B provides electrical power to vital production activities in Buildings 110 and 130. Building 110 houses External Tank production cells for the manufacturing of the LH2 and LO2 tanks; internal and external cleaning; spray-on foam insulation (SOFI) application and curing; LH2 hydrostatic testing; and vehicle staking and mating. Building 130 houses the mix room for the formulation and mixing of super light ablator (SLA) and the pretreatment of cork and micro-balloons. Reliable power for Buildings 110 and 130 is essential to avoid costly disruptions to the External Tank (ET) production schedule.

IMPACT OF DELAY:
Continued operation of unreliable and unsafe electrical equipment at Substation 20A/20B would increase risk of injury to personnel, damage to property, and disruption of ET manufacturing activities. Operations and maintenance costs would stay excessively high. Personnel maintaining antiquated and unsafe equipment would continue to do so at increasing exposure to possible severe injury. Unexpected power disruptions would impact the ET production schedule.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 2001 ESTIMATES

SUMMARY

SCIENCE, AERONAUTICS, AND TECHNOLOGY

	Amount (Thousands)	Page Number
Space Science:		
Construct Laboratory for In-Situ Microbiology (JPL)	13,000	MS 4-12
Life and Microgravity Science and Applications:		
Construct Booster Applications Facility, Brookhaven National Laboratory, Phase 4	8,500	MS 4-13
Aero-Space Technology:		
Replace Fan Blades, National Full-scale Aerodynamic Complex, Phase 3 (ARC)	6,000	MS 4-15
Construct Rocket-Based Combined Cycle (RBCC) Test Facility (SSC)	10,000	MS 4-16
Total Science, Aeronautics, and Technology	37,500	

PROJECT TITLE: Construct Laboratory for In-Situ Microbiology INSTALLATION: Jet Propulsion Laboratory
COGNIZANT OFFICE: Office of Space Science LOCATION: La Canada-Flintridge, Los Angeles County, CA

FY 01 COST ESTIMATE (Thousands of Dollars)	13,000	PRIOR YEARS FUNDING:	1,040
Project Elements:		Construction	---
Sitework	650	Facility Planning and Design	1,040
Architectural/Structural	4,550	Capitalized Investment	---
Mechanical	3,900		
Electrical	3,900		

PROJECT DESCRIPTION:
The Laboratory for In-Situ Microbiology (LIMB) will be a first of its kind facility needed to support outbound spacecraft performing interplanetary sampling. This project constructs a new three-story 3200 square meter laboratory. It will have a large Class 10,000 cleanroom with high ceiling to accommodate clean tents, associated garment areas, air locks and air showers for equipment and personnel access; a Class-1000 cleanroom with a low-vibration environment for prototype development; chambers with thermal-vacuum capabilities; a surface exploration laboratory for development and demonstration of telerobotic systems; and offices for 50 engineers and scientists using these facilities. The structure will be seismically reinforced steel on a concrete foundation and have solar-resistant glass. The LIMB will be sited next to the In-Situ Instruments Laboratory and will use Building 303 utilities to the extent practicable. Special consideration will be given to achieving low vibration levels, and providing an air-handling system with sufficient capacity and filtration for backward and forward biological decontamination. Separate air handling systems will be needed for the biological and biochemical areas, the surface exploration area, and the electronics prototype area.

PROJECT JUSTIFICATION:
The LIMB will allow for the development of interplanetary systems that will search for evidence of past or present life forms from a spacecraft free of contamination from Earth organisms or residue. The proposed, special facility will allow detection and removal of biological contaminants in clean areas developed around new methods and procedures for biological decontamination during hardware fabrication and assembly. These requirements are unprecedented in the history of robotic space missions. The facilities and equipment for meeting them are not available anywhere in the world.

The LIMB will provide cleaning and sterilization at various stages of electronic materials assembly to meet the stringent biological decontamination requirements of flight hardware that will visit other planetary bodies. The LIMB will provide sufficient flexibility and adequate capacity to permit variances in the sequence and procedures to accommodate the new technology needed in the decontamination process for assembly of the electronic materials. For purposes of clarity, this facility will not support research activities on returned samples. This new building represents the program plan at the time of the budget submission to Congress. There may be some adjustment needed to the project based on results of the planned reevaluation of the Mars program.

IMPACT OF DELAY:
NASA will be unable to meet program and project commitments related to In-Situ Microbiology.

PROJECT TITLE: Construct Booster Applications Facility, Phase 4 INSTALLATION: Brookhaven National Laboratory
COGNIZANT OFFICE: Office of Life and Microgravity Sciences and Applications LOCATION: Long Island, NY

FY 01 COST ESTIMATE (Thousands of Dollars):	8,500
Project Element:	
Conventional Construction	1,200
Booster Modifications	1,300
Beam Transport System	2,400
Controls and Personnel Safety System	1,000
Experimental Area Outfitting	1,400
Installation and Services	700
Project Services	500

PRIOR YEARS FUNDING:	12,800
Construction	12,800
Facility Planning and Design	---
Capitalized Investment	---

PROJECT DESCRIPTION:
This project constructs a Booster Applications Facility (BAF) adjacent to the existing Brookhaven National Laboratory (BNL) Alternating Gradient Synchrotron (AGS) Booster. Conventional construction includes site clearing and preparation; new roads and parking areas; booster wall penetration; tunnel construction with access/egress corridors at both ends of the tunnel; and construction of two pre-engineered metal buildings, one for protecting power supplies and switchgear, and the other to provide laboratory workspace. The project modifies the AGS Booster to accommodate installation of hardware required to perform slow extraction. Booster modifications include relocation of the beam dump and a wall current monitor; installation of new septum magnets; provision of new power supplies; rewiring for higher currents; and reconfiguration of exiting vacuum chambers. The project constructs a 63-meter Beam Transport System (BTS) in the new tunnel capable of providing a 20-degree bend (to eliminate direct line-of-sight) between the booster ring and the target area, and capable of distributing the beam over a 15-centimeter x 15-centimeter target area. The BTS consists of a 10-centimeter diameter vacuum pipe with a thin window in front of the target and a fast-closing valve to protect the booster vacuum from a window break; magnetic elements to transport and shape the beam on target; a cooling system using low conductivity water; and cable trays and cabling for direct current (DC) power and controls. The project includes all distributed systems, central services, and process controls required for operation of the BAF, including a relay-based personnel access control system that permits entrance to radiation areas only when safe to do so. The project upgrades one of the two existing BNL Tandem accelerators to 16 megavolts and modifies it to enable concurrent use by AGS and BAF. The project provides for outfitting of the experimental areas for research in biological systems, including dosimeters, computer systems, and other electronic equipment. Project provides for all supporting infrastructure and utilities. This is the fourth increment of this $33.1 million project. Future construction funds in the amount of $11.8 million are budgeted in FY02-03 to complete the project.

PROJECT JUSTIFICATION:
The BAF will provide a ground-based facility in which to conduct important research aimed at understanding and assessing health risks and developing effective countermeasures against galactic cosmic radiation. Such a capability does not currently exist. The BAF will provide the capability to simulate all major ion components and energies of the galactic cosmic rays and solar proton events. Once the BAF becomes operational, BNL will provide NASA access to more than 2,000 beam-hours-per-year in order to meet all of the goals of NASA's Strategic Radiation Health Plan.

The BAF will benefit the International Space Station (ISS) by providing a ground-based facility for meeting operational, scientific, and technology goals in radiation protection. The BAF will provide a capability for accurate calibration of radiation detectors used

to monitor crewmember exposures on ISS and verify doses as regulated by OSHA. It will also provide a facility for developing shielding augmentation for ISS, which would increase astronaut safety and extend crew stays. The BAF will enable critical research and measurements for assessing health risks from heavy-ions that comprise up to 50 percent of the biological dose on ISS. Acquiring this scientific knowledge will allow NASA to maximize crew stay times and reduce costs from excessive crew changes.

The National Research Council and the National Council of Radiation Protections and Measurements in independent reviews have informed NASA that the scientific basis to estimate risk from galactic cosmic radiation during long-term space flight does not exist. The BAF will benefit long-duration missions by providing a unique ground-based facility in which to conduct critical research to obtain knowledge of potential health effects and for the development of ground analogs, biological countermeasures, and radiation shielding strategies.

IMPACT OF DELAY:
Delaying this project would greatly impact NASA's ability to pursue vital research on space radiation effects required to enable development of maximum-exposure guidelines and of radiation countermeasures such as shielding. NASA's ability to safely carry out extended crew stays at the ISS and other potential future long-duration space flightswould be severely curtailed. Delay of this project would also delay our ability to calibrate radiation detectors without which NASA cannot accurately monitor ISS crewmembers' exposure to radiation. These impacts will translate into increased ISS operations cost due to more frequent crew changes, and increased risk to astronauts due to limited knowledge of space radiation effects.

PROJECT TITLE: Replace Fan Blades, National Full-Scale Aerodynamic Complex, Ph 3 INSTALLATION: Ames Research Center
COGNIZANT OFFICE: Office of Aero-Space Technology LOCATION: Santa Clara County, CA

FY 01 COST ESTIMATE (Thousands of Dollars)	6,000	PRIOR YEARS FUNDING:	6,210
Project Elements:		Construction	5,400
Manufacture New Blades	6,000	Facility Planning and Design	810
		Capitalized Investment	---

PROJECT DESCRIPTION:
The scope of this project is to design, manufacture, and install new composite fan blades in the National Full-Scale Aerodynamic Complex (NFAC) at Ames Research Center. Composites are the most viable materials for replacing the temporary repaired blades. Composite blades will be substantially lighter than the current wood blades and have better damage tolerance characteristics, resulting in superior performance and increased durability. Future funding in the amount of $4 million is budgeted to complete this project. When combined with FY 99/00 funding of $5.4 million the total cost of this project is $15.4 million.

PROJECT JUSTIFICATION:
The NFAC is a vital National facility that supports aerodynamic and aeroacoustic testing for research and development of fixed and rotary winged aircraft. The NFAC is comprised of two large-scale wind tunnels that share a common fan drive system. The fan blades have developed significant cracking. An interim repair has been implemented until new blades can be procured. The NFAC fan drive system was modified when the 80 X 120 wind tunnel was added in the late 1970's. Each of six fans was upgraded and the number of blades was increased to 15 per fan. The new blades were made from a laminated wood product called "Hydulignum". This material was used as the main structural component of the blades, while the leading and trailing edges and the outer tip region were made of spruce. The attachment of the blades to the fan drive was accomplished via a metal cuff that was threaded onto the root end of the blade. These blades continued in operation until 1996 when numerous cracks were discovered in the "hydulignum" emanating from the root attachment area. An investigation revealed a higher dynamic loading on the blades than considered in the design. This caused the blades to vibrate at a rate 4 times greater than expected. The blades effectively reached their 40-year "fatigue life" after only 10 years of actual operation. Temporary repairs, consisting of injecting the cracks with high strength epoxy adhesive and wrapping the lower portion of the blade and steel cuff with a carbon composite material, are complete. Based on fatigue tests, the temporary repairs will last for a maximum of 5-6 years. Replacement of the fan blades must be accomplished to avoid potential shutdown of the facility.

IMPACT OF DELAY:
Failure to approve this project will result in increased cost, disruption, and delay to commercial and military aviation programs. If not available in a timely manner, the new blades would not be installed before the repaired blades reach the end of their safe operating lives, thereby causing disruption of NFAC operations.

PROJECT TITLE: Rocket-Based Combined Cycle (RBCC) Test Facility
COGNIZANT OFFICE: Office of Aero-Space Technology

INSTALLATION: Stennis Space Center
LOCATION: Bay St. Louis, MS

FY 01 COST ESTIMATE (Thousands of Dollars)	10,000

PRIOR YEARS FUNDING:	1,000
Construction	---
Facility Planning and Design	1,000
Capitalized Investment	---

PROJECT DESCRIPTION:
Trade studies were initiated in FY 2000 to define the cost and capability of an advanced Rocket-Based Combined Cycle (RBCC) Test Facility necessary to address Spaceliner 100 requirements generated by the Space Transfer and Launch Technology Program. Contractors will be selected to initiate detail designs and specifications of the major systems such as propellant and pressurization systems, air storage and delivery, thrust measurement, instrumentation and control systems.

The advanced RBCC Test Facility activities will be focused on the preliminary design review (PDR). This will be used to finalize the requirements, design approach and major procurements. All civil and site work is to be completed in FY 2001 and activities will be initiated on ancillary systems.

CONSTRUCTION OF FACILITIES

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SUMMARY OF RESOURCES REQUIREMENTS

MISSION SUPPORT APPROPRIATIONS	FY 1999 OPLAN 12/23/99	FY 2000 OPLAN REVISED	FY 2001 PRES BUDGET	Page Number
Discrete Projects	46,100	48,300	82,400	MS 4-18
Minor Revitalization and Construction	68,400	79,300	106,800	MS 4-38
Facility Planning and Design	14,000	14,200	15,700	MS 4-44
Environmental Compliance and Restoration	40,000	40,100	41,000	MS 4-47
TOTAL	168,500	181,900	245,900	
Distribution of Program Amount by Installation				
Johnson Space Center	21,819	14,050	31,820	
Kennedy Space Center	20,875	31,500	49,260	
Marshall Space Flight Center	30,136	25,365	33,010	
Stennis Space Center	12,600	10,925	16,760	
Ames Research Center	14,875	12,655	21,605	
Dryden Flight Research Center	4,357	6,582	5,910	
Glenn Research Center	17,319	19,303	25,030	
Langley Research Center	9,307	20,270	17,900	
Goddard Space Flight Center	18,513	21,320	22,360	
Jet Propulsion Laboratory	15,810	17,138	19,120	
Headquarters	2,889	2,792	3,125	
TOTAL	168,500	181,900	245,900	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 2001 ESTIMATES

SUMMARY

MISSION SUPPORT

	Amount (Thousands)	Page Number
Mission Support Discrete Projects:		
Restore Electrical Distribution System, Phase 3 (ARC)	9,000	MS 4-19
Provide 34.5kV Alternate Feed to Substation G (GRC)	4,500	MS 4-20
Rehabilitate Distributed Control System (GRC)	3,000	MS 4-21
Repair Sanitary Sewer System, Phase 3 (GRC)	4,400	MS 4-22
Repair Site Steam Distribution System, Phase 3 (GSFC)	4,000	MS 4-23
Restore Chilled Water Distribution System, Phase 5 (GSFC)	5,000	MS 4-24
Replace Chillers, Space Flight Operations Facility (JPL)	1,800	MS 4-25
Upgrade 34-Meter Beam Waveguide Antenna Subnet for KA-Band, Network (JPL)	1,900	MS 4-26
Rehabilitate Electrical Distribution System, 200 Area, WSTF (JSC)	2,500	MS 4-27
Construct Operations Support Building, Hypergol Maintenance Facility (KSC)	3,300	MS 4-28
Construct Operations Support Building, Pad B (KSC)	4,000	MS 4-29
Construct Operations Support Building II, LC-39 Area, Phase 1(KSC)	13,000	MS 4-30
Repairs to Primary Electrical Power System, (KSC)	3,500	MS 4-32
Repairs to Electrical Systems, East and West Areas (LaRC)	9,000	MS 4-33
Repair and Modernize Fluid Dynamics Vacuum Pump Facility (MSFC)	2,600	MS 4-34
Replace Roof, Building 4705 (MSFC)	2,400	MS 4-35
Replace Mechanical Equipment and Roof, Building 350 (MAF)	5,800	MS 4-36
Repair Storm Drainage System, Phase 1 (WFF)	2,700	MS 4-37
Total Discrete Projects	82,400	

PROJECT TITLE: Restore Electrical Distribution System, Phase 3
COGNIZANT OFFICE: Office of Aero-Space Technology

INSTALLATION: Ames Research Center
LOCATION: Moffett Field, Santa Clara County, CA

FY 01 COST ESTIMATE (Thousands of Dollars)	9,000
Project Elements:	
Substation Repairs/Upgrades	1,400
Replace Relays	750
Replace Arc Jet Supply Voltage Sys	400
Expand APMS	3,500
Replace/install Switchgear	2,950

PRIOR YEARS FUNDING:	15,457
Construction	4,900
Facility Planning and Design	761
Capitalized Investment	9,796

PROJECT DESCRIPTION:
This project will modernize and repair the Center's primary electrical distribution system as part of a phased program to improve reliability. The full cost of the all phases will be approximately $50M. Due to increasing safety concerns, this phase replaces approximately fifteen (15) 115kv air disconnect switches, eighty-four (84) electro-mechanical relays with microprocessor relays, and forty (40) underground oil switches with above-ground gas circuit breakers. The scope includes installing two (2) new 115kv gas circuit breakers on incoming transmission lines in the main substation; installing a graphic panel in the control room of Substations N225 and N225B to indicate new gas circuit breakers; replacing existing 2,400-volt Arc Jet supply voltage auxiliary system with new 4,160-volt supply; and expanding the Ames Power Monitoring System (APMS) Center-wide to include approximately eighty-four (84) buildings, ten (10) wind tunnels, and five (5) main electrical substations.

PROJECT JUSTIFICATION:
The existing Center-wide electrical system at Ames is worn out, unreliable, and in some cases unsafe. As a result, Ames has experienced increasing instances of power interruptions that have adversely impacted critical research. Much of the electrical equipment, such as the 115,000-volt oil circuit breakers, air operated switches, and metering systems, was installed during or shortly after 1945. The Center frequently must hand fabricate replacement parts because spares are no longer available for the majority of electrical equipment in this system. Many of the oldest electro-mechanical relays at the Center can no longer be calibrated because of worn mechanical components, and replacement parts are no longer available. New relays can be purchased for less cost than repairing the old relays. The existing APMS is over 30 years old. The data transmitted is not dependable and the accuracy of measurement is unpredictable. The existing system is not reliable for monitoring of electrical systems. Existing underground oil switches are unsafe when energized, and many are frequently flooded due to the high water table and infiltration of surface water. The existing Arc Jet 2,400-volt auxiliary supply has deteriorated and is unreliable. Safe operation is dependent on this supply, which provides power to the de-ionized cooling water system.

IMPACT OF DELAY:
Risk of injury to personnel maintaining hazardous underground oil switches would continue. In addition, power outages caused by electrical equipment failure will continue to not only adversely interrupt mission-critical research across the Center, but also prevent the Center from operating in an efficient, cost effective manner.

PROJECT TITLE: Provide 34.5 kV Alternate Feed To Substation G
INSTALLATION: Glenn Research Center
COGNIZANT OFFICE: Office of Aero-Space Technology
LOCATION: Cleveland, OH

FY 01 COST ESTIMATE (Thousands of Dollars)	4,500
Project Elements:	
Duct bank to Substation G	3,900
34.5 KV Cable, Terminations, Splices	500
Breaker, Disconnects, Controls, Relaying	100

PRIOR YEARS FUNDING:	450
Construction	---
Facility Planning and Design	450
Capitalized Investment	---

PROJECT DESCRIPTION:
This project installs a permanent 25-megawatt alternate power supply to meet the base institutional needs of the Glenn Research Center (GRC) at Lewis Field in case of an extended interruption to the existing main supply of power from the Cleveland Electric Illuminating CO. (CEI). The project consists of installation of a permanent 25-megawatt alternate power supply to Substation G at GRC from an alternate Cleveland Electric Illuminating Co. (CEI) power source. The work includes a CEI designed and constructed underground duct bank with 34.5 KV cables from CEI's 34.5 KV tie point near Brookpark Rd. to Substation G. Work also includes installation of tie breaker with foundation at Substation G disconnects, relays, terminations, splices, controls, and protective relaying as required.

PROJECT JUSTIFICATION:
Glenn Research Center receives their full, 375-Megawatt electrical energy requirement from only one supply source; a single point of failure situation unique in NASA. The existing aerial, high-tension lines lay just below the aircraft approach and takeoff envelopes for the proposed new runways planned as part of the pending expansion of Cleveland airport. The potential of an extended interruption to the existing power supply presently exists and will statistically increase with the airport expansion adjacent to GRC. This power consists of both the approximate 25 megawatts needed to keep all institutional aspects (which include lighting, environmental systems, computing systems, and life safety systems) of over 100 facilities operational and the approximate 350 megawatts required for research operations at the facilities. This project only insures that base institutional power needs will be met if the main power supply is interrupted, not the much larger demand for research operations.

IMPACT OF DELAY:
Higher volumes of air traffic expected from the addition of a new airport runway and extension of other runways increases the probability of a loss of total supply power to GRC due to an aircraft accident. A minimum of three weeks would be required to restore some temporary power to GRC. The start of any activity for restoration of power would be impacted by such things as a FAA investigation and the clearing of debris from the site.

PROJECT TITLE: Rehabilitate Distributed Control System
COGNIZANT OFFICE: Office of Aero-Space Technology

INSTALLATION: Glenn Research Center
LOCATION: Cleveland, OH

FY 01 COST ESTIMATE (Thousands of Dollars)	3,000
Project Elements:	
Master Stations (Hardware/Software)	1,500
Field Processors	1,000
Local Control/Instrumentation	500

PRIOR YEARS FUNDING:	1,897
Construction	---
Facility Planning and Design	300
Capitalized Investment	1,597

PROJECT DESCRIPTION:
The Distributed Control System Monitoring Station is located in the Central Control Building (143) and provides centralized equipment operator stations, air distribution scheduling, electrical power distribution, data collection, and operational reporting that must be modernized. This project rehabilitates aging signal conditioning and uninterruptible power supply equipment, modifies central process systems control to provide full automation, installs improved remote machinery monitoring, and upgrades distributed control system hardware and software.

PROJECT JUSTIFICATION:
The Distributed Control System is critical for providing safe centralized operational support of process systems for research programs associated with the development of advanced aeropropulsion systems. The industry standard for useful life of computer hardware and software is nominally three years although NASA routinely exceeds this standard. However, the Distributed Control System hardware and software is over ten years old. Equipment is obsolete and spare parts no longer available. This project is required to eliminate remaining manual control and monitoring. This project enhances machinery monitoring to improve reliability, reduces unforeseen maintenance, and minimizes the need to expose floor personnel to hazards and noise.

IMPACT OF DELAY:
The delay of this project significantly increases the risk of unscheduled and lengthy shutdowns of one or more major aeronautical research facilities.

PROJECT TITLE: Repair Sanitary Sewer System, Phase 3
COGNIZANT OFFICE: Office of Aero-Space Technology

INSTALLATION: Glenn Research Center
LOCATION: Cleveland, OH

FY 01 COST ESTIMATE (Thousands of Dollars)	4,400
Project Elements:	
Sanitary Sewers	3,300
Storm/Industrial Waste Sewers	1,100

PRIOR YEARS FUNDING:	2,962
Construction	---
Facility Planning and Design	524
Capitalized Investment	2,438

PROJECT DESCRIPTION:
This project is the third of five phases to repair the aging sanitary sewer system. The scope includes replacing sewer mains, eliminating cross connections between sanitary and storm water systems, and repairing/installing oil-water separators. It also includes excavation, backfill, and pavement repair necessary to replace sewer lines and manholes. It will improve the hydraulics of the system, greatly reduce maintenance and operating costs, and eliminate noncompliance discharges to the storm outfalls. Funds will be requested in FY 2002 and 2003 to restore other segments of the sewer system.

PROJECT JUSTIFICATION:
The existing sanitary sewer system is more than fifty years old and is in poor condition. This project will reduce treatment and maintenance costs associated with operating the aging sanitary sewer system and eliminate nonconformance discharges to storm outfalls. This project will reduce maintenance costs by reducing the need for emergency repairs on broken lines. It will reduce treatment costs by reducing inflow and infiltration into the sanitary sewer. In addition, it will eliminate noncompliance discharges to storm outfalls caused by broken sanitary lines and cross connections to comply with National Pollution Discharge Elimination System permits.

IMPACT OF DELAY:
Without the project, avoidable and costly treatment of storm water discharged through the sanitary sewer system will continue. In addition, continued breaks and blockages in sewer lines are likely to occur, requiring costly emergency repairs. Continued noncompliance notices could result in increased inspection, increased monitoring, and fines by the Ohio EPA.

PROJECT TITLE: Repair Site Steam Distribution System, Phase 3

INSTALLATION: Goddard Space Flight Center

COGNIZANT OFFICE: Office of Earth Science

LOCATION: Greenbelt, MD

FY 01 COST ESTIMATE (Thousands of Dollars)	4,000
Project Elements:	
Replace northeast header	1,880
Replace northwest header	880
Replace piping for Bldgs 1, 2, & 13	940
Replace other related piping	300

PRIOR YEARS FUNDING:	7,223
Construction	4,900
Facility Planning and design	285
Capitalized Investment	2,038

PROJECT DESCRIPTION:

This project is the third of five phases to repair major portions of the central steam distribution system at Goddard Space Flight Center (GSFC). The scope includes replacing northeast header, northwest header, and other related piping and insulation. Approximately $7 million will be required in FY 2002/2003 to repair other portions of the site steam distribution system.

PROJECT JUSTIFICATION:

The central steam distribution system was originally installed in the early 1960s and is at the end of its useful life. The system has deteriorated to the point that corrosion is causing pipes to break and valves to leak. Concrete manholes are deteriorated from steam and condensate leakage causing damage to the surrounding landscape and roadway. The site steam distribution system has become undersized due to substantial growth in buildings and related steam demand. The added steam loads on the East Campus require significant upsizing of the main headers. Some condensate and high pressure drip lines have failed. The condensate is piped to drain, resulting in waste of water, energy and treatment chemicals. In addition, the leakage of condensate to ground water is in violation of environmental regulations. Extensive insulation failures have resulted in energy losses and damage to site landscaping and pavement. This project will reduce operation and maintenance costs and enhances reliability as well as the ability to maintain the site steam distribution system.

IMPACT OF DELAY:

A major failure could occur in the campus-wide steam distribution system, resulting in the loss of steam supply to several buildings. This would seriously impact the critical operations in those buildings. The delay will also increase operation and maintenance costs necessary to keep the deteriorated system operational.

PROJECT TITLE: Restore Chilled Water Distribution System, Phase 5

INSTALLATION: Goddard Space Flight Center

COGNIZANT OFFICE: Office of Earth Science

LOCATION: Greenbelt, MD

FY 01 COST ESTIMATE (Thousands of Dollars)	5,000
Project Elements:	
Replacement of NW header from Bldg 24 to Bldgs 18, 19, 20	1,150
Replacement of feed lines to BldgS 4 & 28	1,250
Replacement of eastern loop for Bldgs 16, 12	1,100
Replacement of feed line to Bldg 8, 16, & 19	450
Replacement of line from South Header to Bldg 13	600
Miscellaneous related construction cost	250
Other Costs	200

PRIOR YEARS FUNDING:	25,068
Construction	13,071
Facility Planning and Design	400
Capitalized Investment	11,597

PROJECT DESCRIPTION:
This project is the fifth of seven phases to replace major portions of the GSFC chilled water distribution system. The scope includes replacing part of the northwest header from Building 24 to Buildings 18, 19, 20; feed lines to Building 4; the feed line to Building 28 and its interconnection with the Buildings 18, 19, 20 header; part of the eastern loop for Buildings 16 and 12, including the feed line to Building 12; feed line to Building 8; feed line to Building 19; feed line to Building 16; and the line from the South header to Building 13. Approximately $3 million will be required in FY 2002 to restore other segments of the chilled water distribution system.

PROJECT JUSTIFICATION:
GSFC has experienced serious hydraulic problems with the chilled water distribution system. The campus-wide 30-year-old chilled water distribution system has deteriorated with age and become undersized due to substantial growth in buildings and related chilled water demand at GSFC. This is causing inadequate flow and pressure in the chilled water distribution system in various buildings, pipe breaks, inoperable valves, and other similar problems. Many sections of piping do not have shut off valves. The new lines will improve reliability and cooling conditions in several buildings.

IMPACT OF DELAY:
Delay of this project will result in continued leaking and failures due to old piping and increasing pressures. Some of the system will experience flow deficiencies unless pipe sizes are increased. As a result, several buildings will have inadequate chilled water quantities and air conditioning capacity causing shutdown of mission critical and technical support operations. The delay will also increase operation and maintenance costs required to keep the deteriorated system operational.

PROJECT TITLE: Replace Chillers, Space Flight Operations Facility
COGNIZANT OFFICE: Office of Space Science

INSTALLATION: Jet Propulsion Laboratory
LOCATION: La Canada-Flintridge, Los Angeles County, CA

FY 01 COST ESTIMATE (Thousands of Dollars)	1,800
Project Elements:	
Sitework	100
Architectural/Structural	150
Mechanical	1,250
Electrical	300

PRIOR YEARS FUNDING:	18,954
Construction	---
Facility Planning and Design	108
Capitalized Investment	18,846

PROJECT DESCRIPTION:
This project replaces three old, inefficient 500,000-ton air conditioning water chillers and related equipment in the Space Flight Operations Facility, Building 230. The three new 350,000-ton replacement water chillers will be state-of-the art, high efficiency units that comply with Southern California Air Quality Management District (SCAQMD) standards utilizing an environmentally acceptable refrigerant. The aging, maintenance intensive, chilled water pumps will be replaced with pumps that match the new chillers and the building's requirements. Special accommodations will be made to provide alternate cooling capacity to keep this very critical building in operation during this construction project.

PROJECT JUSTIFICATION:
It is essential that the chillers for this building be reliable because they provide cooling capacity for the computers that help to control all of NASA's deep space missions. The chillers in this building will be over twenty years old at the time of replacement. The chillers are unreliable because repairs have become more frequent and expensive to accomplish. One chiller takes an inordinate amount of time to start and tends to self-trip off when running. Another Chiller has corrodedcreating plugged and leaking tubes that require frequent maintenance and replacement. Because new computers require less electrical power and produce less heat, the chillers are not operating in their peak efficiency range. This shortens their useful life and makes them more susceptible to maintenance problems. Replacing the three 500 ton chillers with three 350-ton units will significantly lower energy consumption and the need for frequent repairs. The high usage of the mission control center severely constrains the scheduling of repair work and results in much higher costs for the repairs.

IMPACT OF DELAY:
Delay of this project results in continued risk of chiller failure and inefficient system operation. This wastes energy and increases costs. A lengthy outage caused by failure of the chillers would interrupt Deep Space Network support to flight projects, pose a safety hazard to personnel, and result in extensive damage to equipment.

PROJECT TITLE: Upgrade 34-Meter Beam Waveguide Antenna Subnet for Ka-Band
COGNIZANT OFFICE: Office of Space Science

INSTALLATION: Jet Propulsion Laboratory
LOCATION: Goldstone, CA; Canberra, Australia; and Madrid, Spain

FY 01 COST ESTIMATE (Thousands of Dollars)	1,900
Project Elements:	
Azimuth and Elevation Encoder Mounting	300
Pedestal & Shroud Modifications	220
Antenna Alidade Modifications	1,380

PRIOR YEARS FUNDING:	46,250
Construction	---
Facility Planning and Design	111
Capitalized Investment	46,139

PROJECT DESCRIPTION:
This project modifies the 34M Beam Waveguide (BWG) Antennas in the Deep Space Network (DSN) to support the implementation of Ka-Band. The project entails removing and replacing the current 32-segment azimuth encoder gear rack with a one piece gear rack. Also included are the azimuth encoder mounting and encoder assembly cover; removing and replacing the elevation encoder mounting hardware and flexible couplings; installing insulation and weather shield to critical members of the alidade structure; and modifying the pedestal radio frequency shroud to allow installation of the Ka-Band feed system.

PROJECT JUSTIFICATION:
The DSN is committed to support multiple deep space projects whose data rates require the added capability of Ka-Band reception. This capability has been implemented at a single station (DSS-25) and the design and operation was verified by using the modification with the Deep Space-1 Project. One of the first missions that will require this capability is a Europa lander. To operate onKa-Band the Antennas must operate under very stringent pointing requirements, which in turn, requires modifications to pedestal, alidade, encoder mounting and associated facility portions of the antennas. Ka-Band will provide larger amounts of command and control guidance to flight hardware in less time.

IMPACT OF DELAY:
This project is required to meet the communications data load requirement for the growing number of planned deep space missions in a cost effective and efficient manner. If this project is not accomplished, then the Deep Space Network will be unable to support future spacecraft missions currently planned to operate using Ka-Band frequencies. Construction of additional antennas at much higher cost would be needed to accommodate the scheduled increase in data load. Without adequate support from the DSN, the deep space missions will be unable to download all the valuable data that each mission is intended to collect.

PROJECT TITLE: Rehabilitate Electrical Distribution System, 200 Area INSTALLAION: White Sands Test Facility
COGNIZANT OFFICE: Office of Space Flight LOCATION: Las Cruces, Dona Ana County, NM

FY 01 COST ESTIMATE (Thousands of Dollars):	2,500
Project Element:	
Transformers and Protective Devices	370
Switchgear	600
Interconnecting Systems	640
Concrete Foundations	65
Motor Control Center	625
Power Conditioning Devices	70
Miscellaneous	130

PRIOR YEARS FUNDING:	695
Construction	---
Facility Planning and Design	200
Capitalized Investment	495

PROJECT DESCRIPTION:
This project rehabilitates the electrical distribution system located at the 200 Area of the White Sands Test Facility (WSTF). Electrical distribution and utilization interface equipment and interconnecting wiring systems will be replaced or modified to provide maintenance bypass circuits, fault protection circuits, load management control, and modern equipment protection. Utilization interface work includes replacing or installing panel boards, load centers, circuit breakers, transformers, power conditioners, and phase protection; reconfiguring circuits to match user requirements; & installing databased load and configuration management system. Distribution work includes replacing and installing 25,000-volt pad mounted distribution transformers and terminal enclosures, lightning arresters, terminations, switchgear, interconnecting wiring and raceway systems, and foundations.

PROJECT JUSTIFICATION:
This project is required to assure continued, reliable, and safe electrical supply to the WSTF technical service areas and test facilities, including component and assembly test areas, clean rooms, chemistry labs, photo/video areas, and supporting offices and equipment. The existing electrical systems and substation will have been in continuous service in excess of 35 years and can no longer support all building expansions and other ad hoc modifications made over the years. The systems have limited fault protection circuits, are marked by numerous failures, and their capacity and flexibility are marginal. Replacement components necessary to maintain continued use of existing obsolete equipment which is no longer available from the original manufacturer. Consequently, replacement parts are costly and cannot be obtained in a timely manner. The systems have no efficient way of accommodating modifications or supporting additional loads. Special circuits and transient voltage protection systems are required to minimize power fluctuations that damage sensitive electronic equipment. Fault protection and maintenance bypass circuit modifications are required to provide added isolation of areas in emergency situations.

IMPACT OF DELAY:
Continued operation of unreliable and unsafe electrical equipment risks injury to personnel and damage to property in the affected buildings and test areas. Failure of this substation or its ancillary electrical equipment is likely at any time and would cause prolonged disruptions to testing and other operational activities. Operations and maintenance costs would stay excessively high. Personnel maintaining antiquated and unsafe equipment would continue to do so at risk of injury.

PROJECT TITLE: Construct Operations Support Building, Hypergol Maintenance Facility INSTALLATION: Kennedy Space Center
COGNIZANT OFFICE: Office of Space Flight LOCATION: Brevard County, Merritt Island, FL

FY 01 COST ESTIMATE (Thousands of Dollars):	3,300	PRIOR YEARS FUNDING:	330
Project Element:		Construction	---
Site Work and Utilities	350	Facility Planning and Design	330
Architectural and Structural	1,750	Capitalized Investment	---
Mechanical	650		
Electrical	550		

PROJECT DESCRIPTION:
This project constructs an Operations Support Building in the Hypergol/Payload Test Area. The facility will be approximately 19,000 square feet and accommodate approximately 100 workers. The new facility will consist of offices, training rooms, computer rooms, technical documentation storage, miscellaneous support areas, and storage. Facility systems to be included are heating, ventilation, and air conditioning (HVAC); power; natural gas; water; sewage; fire detection and protection; and paging and area warning systems. The project will also upgrade the existing central utilities and control systems in order to support the new facility. Non-construction funding in the amount of $250,000 will be budgeted to outfit and activate the facility.

PROJECT JUSTIFICATION:
This project replaces approximately 17,000 square feet of grossly substandard workspace used by approximately 100 people supporting hazardous operations in the Hypergol/Payload Test Area. The substandard workspace consists of two deteriorated 35-year-old buildings (M7-961 and M7-1061, approximately 7,000 square feet) that are functionally inadequate and not economically viable to repair, and fifteen 20-year old dilapidated trailer units (approximately 10,000 square feet) with an original design-life of about six years. The workspace is required to enable timely and reliable turnaround testing of the Orbiter Aft Propulsion System (APS) and Forward Reaction Control System (FRCS) hazardous hypergolic propulsion and steering thrust modules.

The extreme state of disrepair of the existing facilities and trailers is contributing to intensive and unscheduled maintenance having excessive costs; highly inefficient and costly energy consumption; and working environments that barely meet minimum safety and health standards for occupancy. Trailers and modular buildings at KSC have 24 times more environmental health complaints than comparable permanent facilities at KSC. This project is essential to assure a safe and healthful working environment for engineers and technicians performing hazardous operations work.

IMPACT OF DELAY:
People would continue to work in deteriorated substandard facilities, which adversely affects morale and productivity, and could potentially compromise the safety of personnel, property, and critical flight hardware. Operations and maintenance costs and energy consumption would stay excessively high. Productivity would continue at lower levels also because people working on the same activities are not in close proximity to each other.

PROJECT TITLE: Construct Operations Support Building, Pad B
COGNIZANT OFFICE: Office of Space Flight

INSTALLATION: Kennedy Space Center
LOCATION: Brevard County, Merritt Island, FL

FY 01 COST ESTIMATE (Thousands of Dollars):	4,000
Project Element:	
Site Work and Utilities	420
Architectural and Structural	2,100
Mechanical	800
Electrical	680

PRIOR YEARS FUNDING:	320
Construction	---
Facility Planning and Design	320
Capitalized Investment	---

PROJECT DESCRIPTION:
This project constructs an Operations Support Building in the Launch Complex 39, Pad B Area. The facility will be approximately 25,000 square feet, and accommodate approximately 100 technicians and engineers that provide 3-shift processing support. The new facility will be of permanent masonry construction and will have offices, training rooms, and technical documentation storage. Facility systems to be included are heating, ventilation, and air conditioning (HVAC); power; natural gas; water and sewage; fire detection and protection; and paging and area warning systems. The project will also upgrade the existing central utilities and control systems in order to support the new facility. Non-construction funding in the amount of $1.5 million will be budgeted to provide for systems furniture, communication systems, computer equipment, and other such outfitting and activation costs.

PROJECT JUSTIFICATION:
This project replaces approximately 40 temporary boxcar units (approximately 22,000 square feet) used to provide operations support space for approximately 100 workers supporting launch pad processing, and test and checkout operations. The substandard workspace consists of 50-year-old railroad boxcars that were modified and converted to office use almost 20 years ago. The heavy salt corrosive environment of Florida's Atlantic coast has aggressively attacked and severely corroded these now dilapidated boxcars. The units have exceeded their intended useful service life due to significant structural degradation and have become maintenance intensive. The severe state of degradation of these facilities creates a poor workplace environment that adversely affects worker morale and productivity and could potentially affect their safety and health. Trailers and modular buildings at KSC have 24 times more environmental health complaints than comparable permanent facilities at KSC. The extreme state of disrepair of these boxcars is contributing to intensive and unscheduled maintenance having excessive costs; highly inefficient and costly energy consumption; and working environments that barely meet minimum safety and health standards for occupancy. This project is essential to assure a safe and healthy workplace environment for engineers and technicians performing critical operations work affecting timely and reliable launch of the Space Shuttle.

IMPACT OF DELAY:
People performing day-to-day shift support would continue to work in deteriorated substandard facilities, which adversely affects their morale and productivity, and could potentially affect their health and safety. Operations and maintenance costs and energy consumption would stay excessively high. Productivity would continue at lower levels also because people working on the same activities are not in close proximity to each other.

PROJECT TITLE: Construct Operations Support Building II, LC-39 Area , Phase 1
INSTALLATION: Kennedy Space Center
COGNIZANT OFFICE: Office of Space Flight
LOCATION: Brevard County, Merritt Island, FL

FY 01 COST ESTIMATE (Thousands of Dollars):	13,000
Project Element:	
Site Work and Utilities	3,000
Architectural and Structural	7,000
Mechanical	2,000
Electrical	1,000

PRIOR YEARS FUNDING:	2,400
Construction	---
Facility Planning and Design	2,400
Capitalized Investment	---

PROJECT DESCRIPTION:
This project provides for the construction of a second Operations Support Building in the LC-39 Vehicle Assembly Building (VAB) area. The complex will be approximately 200,000 square feet and accommodate approximately 1,000 workers. The complex will support operational areas and consist of offices, training rooms, computer rooms, multi-media conference rooms, Mission Conference Center with observation deck, technical libraries, Exchange storage, snack bar, storage, miscellaneous support areas, and parking. Facility systems to be included are heating, ventilation, and air conditioning (HVAC); power; natural gas; water; sewage; fire detection and protection; and paging and area warning systems. The project will also upgrade the existing central utilities and control systems in order to support the new complex. A second and final phase estimated at $7 million is required in FY 2002 to complete this facility, bringing the total estimated construction cost to $20 million. Non-construction funding in the amount of $14 million will be budgeted to provide for systems furniture, communication systems, computer equipment, and other such outfitting and activation costs.

PROJECT JUSTIFICATION:
A critical need exists in the LC-39 VAB Area to eliminate 280 trailer equivalents of dilapidated substandard housing affecting the safety, morale and welfare of approximately 700 Shuttle processing workers, transient Launch fallback personnel, and personnel who attend training. Completion of this project will also allow consolidation of fragmented programs affecting approximately 300 workers currently scattered across the Center supporting Launch Complex 39 operations and Spaceport Technology Center strategies. This consolidation will enable KSC to eliminate additional substandard housing when the vacated permanent housing currently being used by the fragmented programs is backfilled.

The heavy salt corrosive environment of Florida's Atlantic coast has aggressively attacked and severely corroded the existing facilities which consist of 20-year-old portable office trailers and modified railroad boxcars. These facilities have mold and indoor air quality problems; siding and floor substructures that are rotting and termite infested; roof and siding that are leaking water; plumbing that does not drain properly; tripping hazards, such as uneven floors and exterior stairs that are wobbly and unstable; and numerous other code violations. Trailers and modular housing at KSC have 24 times more environmental health complaints than comparable permanent facilities at KSC. This situation is contributing to intensive and unscheduled maintenance having excessive costs; highly inefficient and costly energy consumption; and working environments that barely meet minimum safety and health standards for occupancy.

IMPACT OF DELAY:
People would continue to work in deteriorated substandard housing, which adversely affects morale and productivity. Maintenance would continue to cost approximately $1.3 million/year more than for conventional permanent facilities and 47%

more energy would continue to be consumed. Productivity would continue at lower levels also because people working on the same program are not in close proximity and have to travel greater distances.

PROJECT TITLE: Repairs to Primary Electrical Power System
COGNIZANT OFFICE: Office of Space Flight

INSTALLATION: Kennedy Space Center
LOCATION: Brevard County, Merritt Island, FL

FY 01 COST ESTIMATE (Thousands of Dollars):	3,500
Project Element:	
Demolition	250
New Transformers	1,200
New Circuit Breakers	1,450
Emergency Feeder	350
Bus Structural Modifications	250

PRIOR YEARS FUNDING:	19,446
Construction	---
Facility Planning and Design	150
Capitalized Investment	19,296

PROJECT DESCRIPTION:
This project repairs critical components of the primary electrical power system at KSC. The project replaces transformers and oil circuit breakers at the Orsino primary substation; replaces oil circuit breakers at the C-5 primary substation; and replaces the Utility Annex Emergency Power diesel-generator system with a substation direct feeder.

PROJECT JUSTIFICATION:
This project is essential to assure safe and reliable electrical power for KSC launch operations; payloads, shuttle, and space station processing; and administration and engineering support activities. The repairs to the Orsino and C-5 primary substations will modernize and improve the safety and reliability of the primary electrical power infrastructure at KSC. The modifications to the Utility Annex Emergency Power System will overcome an existing diesel startup time-deficiency. All work to be accomplished by this project is required to achieve compliance with fire and life safety codes.

System components and equipment at all locations exceed 30-year design life expectancy. Spare parts are difficult and costly to obtain in a timely matter because they are no longer in production. The Orsino Substation transformers present a fire hazard condition because they do not meet Fire Code minimum installation clearances. The existing 15 kV class oil circuit breakers present a safety hazard to maintenance personnel because they do not meet National Electrical Code minimum installation clearances between high voltage parts and electrical ground. The Utility Annex uses a diesel generator for emergency power that does not satisfy the Life Safety Code criteria for start-up within 10 seconds after loss of primary power.

The Orsino substation supplies electrical power for the Industrial Area Administration and Engineering Support Buildings; the Operations and Checkout Facility; the Hypergol Maintenance Facility; the Payloads Test Area; the Space Station Processing Facility; and the Industrial Area Chiller Plant. The C-5 Substation and its Utility Annex Emergency Power System supplies electrical power for critical Shuttle processing/launch activities in the Vehicle Assembly Building area and LC-39 launch complex.

IMPACT OF DELAY:
Continued operation of unreliable and unsafe electrical equipment at KSC increases the risk of injury to personnel, damage to property, and interruption of payload processing and launch operations. Operations/maintenance costs would stay excessively high. Personnel maintaining antiquated and unsafe oil circuit breakers would continue to do so at risk of severe injury.

PROJECT TITLE: Repairs to Electrical Systems, East and West Areas
COGNIZANT OFFICE: Office of Aero-Space Technology

INSTALLATION: Langley Research Center
LOCATION: Hampton, VA

FY 01 COST ESTIMATE (Thousands of Dollars)	9,000
Project Elements:	
WP 1 - Substation Electrical Repairs (642 & 1233)	2,400
WP 2 - Electrical Repairs (1265 & 1273A)	950
WP 3 - Electrical Repairs (1152, 1201, 1209, & 1219)	550
WP 4 - Electrical Repairs (1221, 1236, 1239, & 1247B)	2,400
WP 5 - Electrical Repairs (1251 & 1267A)	2,700

PRIOR YEARS FUNDING:	4,525
Construction	---
Facility Planning and Design	577
Capitalized Investment	3,948

PROJECT DESCRIPTION:
This project repairs and replaces the major portions of the Langley Research Center's (LaRC) High Voltage Power System. The project is required to assure continued reliability and safe electrical power supply at LaRC. The system distributes power to all of the Center's aerospace research and development facilities, the computer center, and institutional facilities. This project replaces various oil circuit breakers and transformers at the Back River Substation (B642) and Stratton Substation (B1233), and it replaces various equipment including circuit breakers, transformers, and switchgear in the unit substations at Buildings 1265, 1273A, 1236, 1152, 1201, 1209, 1219, 1239, 1221, 1247B, 1251, and 1267A.

PROJECT JUSTIFICATION:
The high voltage power system provides power to all the aeronautics and aerospace Research and Development facilities to support major research programs. It is over 50 years old with obsolete circuit breakers, switchgear, and transformers that are practically impossible to maintain causing frequent and costly emergency repairs each year. Failure of existing circuit breakers is imminent and could result in a 6 to 12-month shutdown of research facilities. Economic analysis indicates this project is the most cost-effective approach to maintain an operating system for the next 25 years.

IMPACT OF DELAY:
Failure rates currently being experienced will increase if repairs to the high voltage power system are delayed. Major disruptions of electrical services, associated with single point failures, are anticipated. These failures will result in the shutdown of critical research facilities and the programs they support for periods up to 12 months.

PROJECT TITLE: Repair and Modernize Fluid Dynamics Vacuum Pump Facility
INSTALLATION: Marshall Space Flight Center
COGNIZANT OFFICE: Office of Space Flight
LOCATION: Madison County, AL

FY 01 COST ESTIMATE (Thousands of Dollars):	2,600	PRIOR YEARS FUNDING:	310
Project Element:		Construction	---
Architectural and Structural	375	Facility Planning and Design	260
Mechanical	1,700	Capitalized Investment	50
Electrical	525		

PROJECT DESCRIPTION:
This project replaces the vacuum pumping system of the Fluid Dynamics Vacuum Pump Facility (Building 4734) with a modern fully automated system of similar configuration, but with upgraded capabilities. The new pumps will have a pumping capacity of approximately 13,200 cubic feet per minute at atmospheric pressure and will be capable of achieving an ultimate vacuum of 0.39 inches (10 millimeters) of mercury in 15 minutes. The vacuum field consists of six 7,000-cubic-foot vessels for a total capacity of 42,000 cubic feet. All motors, piping, and associated components will be repaired or replaced. Supporting infrastructure will be upgraded to accommodate the new vacuum pumping system and to bring the facility into compliance with latest Life-Safety and Building codes. The project also provides for a 5-ton crane and a covered walkway between Building 4732 and Building 4734.

PROJECT JUSTIFICATION:
The Fluid Dynamics Vacuum Pump Facility supplies a Trisonic Wind Tunnel (TWT) in Building 4732, which is vital for MSFC to perform its assigned roles and missions. This project restores lost vacuum pumping capability, reduces time required to obtain required vacuum pressures, increases/conserves test time, and improves overall effectiveness and performance of the TWT. Presently one fourth of the pumping capability is inoperable. Spare parts cannot be obtained, and the individual pumps cannot be replaced in-kind because they are obsolete and no longer in production. The time needed to obtain the required vacuum conditions in the TWT is excessive. This project replaces the pumps and motors in Building 4734 in order to reduce the time needed to obtain required vacuum conditions, improve reliability, and reduce maintenance costs. The new pumping modules will be optimized to provide maximum efficiency and flexibility of operation. The waste oil containment system will be upgraded to improve operational efficiency. Workspace and clearances around equipment currently do not comply with the mandated requirement of the National Electrical Code for assuring safe access for service and maintenance personnel. This project corrects this non-compliance and also provides improved equipment replacement routes to accommodate equipment change-out during service and maintenance operations. The old controls for the TWT vacuum system will be replaced to conserve test time.

IMPACT OF DELAY:
Twenty-five percent of the pumps at this facility are already inoperable and additional pump failures are highly likely in the near future. A delay of this project puts the TWT at high risk of a further reduction in testing capability. Continued operation of this facility without the benefits of the proposed efficiency and performance upgrades will greatly impact progress of multiple on-going research and development activities and continue to drain scarce operations and maintenance resources.

PROJECT TITLE: Replace Roof, Building 4705, Phase 2
COGNIZANT OFFICE: Office of Space Flight

INSTALLATION: Marshall Space Flight Center
LOCATION: Madison County, AL

FY 01 COST ESTIMATE (Thousands of Dollars):	2,400
Project Element:	
Architectural and Structural	2,170
Mechanical	185
Electrical	45

PRIOR YEARS FUNDING:	8,356
Construction	1,000
Facility Planning and Design	137
Capitalized Investment	7,219

PROJECT DESCRIPTION:
This project replaces the roof systems adjoining the main high bay roof of Building 4705. Work includes replacing roofing east, west, and north of the main high bay roof (Sections B, D, E1, N2, N, O, P, Q, R, S, M, K, H2, T, J, H1) with a blue standing seam metal roof system. A light gauge metal framing system will be built up and attached to the existing major roofing structural members to provide a minimum roof slope. New flashing, gutters, strainers, and down spouts will be installed to make the roof watertight. Modifications will be made to roof mounted mechanical system components and roof penetrations, as required, to accommodate the work.

PROJECT JUSTIFICATION:
The purpose of this project is to alleviate existing roofing problems resulting from years of seasonal weathering. The roof of this facility, which houses portions of the Materials, Processes and Manufacturing Department, is in need of total repair due to age and deterioration. The normal roof life expectancy at MSFC is 25 years. The roof of Building 4705 (built in 1955) has far exceeded its useful life. This project is required to alleviate leaks and other deficiencies; to improve and extend roof system reliability to protect mission support activities; and to reduce the roofing maintenance backlog.

The primary functions of the facility are welding sensor and robotic welding development, sheet metal assembly, and precision cleaning. The facility has clean rooms for processing experimental and flight hardware. Through these functions, the facility supports all NASA Strategic Enterprises. A project to replace the adjacent main high bay roof was funded in FY 2000. This FY 2001 project addresses the surrounding/adjoining roof areas. Repair of the roof sections east, west, and north of the main high bay is essential to protect and preserve facility capability and to remove the threat of unscheduled interruptions to development and simulation operations.

IMPACT OF DELAY:
A delay of this project would allow the existing roof to degrade to failure, putting the weather integrity of the structure at risk. The future cost of this work would then be significantly higher. Progressively higher water intrusion rates would occur, which would impact development functions and activities of the facility users. These higher water intrusion rates would also risk damage to experimental and flight hardware, and to the interior of the building. The high frequency and excessive cost of maintenance would continue to increase.

PROJECT TITLE: Replace Mechanical Equipment and Roof, Building 350
COGNIZANT OFFICE: Office of Space Flight

INSTALLATION: Michoud Assembly Facility
LOCATION: New Orleans, Orleans Parish, LA

FY 01 COST ESTIMATE (Thousands of Dollars):	5,800
Project Element:	
Architectural and Structural	4,150
Mechanical	1,475
Electrical	175

PRIOR YEARS FUNDING:	9,158
Construction	---
Facility Planning and Design	458
Capitalized Investment	8,700

PROJECT DESCRIPTION:
This project replaces the roof of Building 350. The roof replacement entails removing the ballast, installing foam insulation, applying lightweight cement, installing a 2-ply roofing system, and extending the drain downspout to the sloped roof. This project also replaces selected chillers and boilers that service Building 350 although they are physically located in the Building 351 equipment room. Two chillers (2,100-kilowatt each) will be replaced with one chiller of 4,300-kilowatt nominal capacity. A steam boiler and a hot water boiler will be replaced in kind.

PROJECT JUSTIFICATION:
This project eliminates existing roofing problems resulting from 23 years of seasonal weathering. The roof exhibits widespread bare and soft spots, blisters, open laps, felt deterioration, and rusting of the metal components typical of a roof that has reached the end of its useful life. The building has already experienced leaks in several areas and has numerous point repairs. This project eliminates leaks and other deficiencies; improves and extends roof system reliability; and reduces the roofing maintenance backlog.

The two chillers service Buildings 350 and 351 and have been in service since 1980. These chillers have numerous refrigerant leaks, plugged and severely corroded tubes, corrosion of shell wall thickness to one-half original specification, and obsolete starter parts requiring workarounds or custom-made parts. The two boilers also have major deficiencies, such as leaking tubes that have reduced capacity causing a loss of operational efficiency; pitting on internal surfaces causing heat transfer loss and metal fatigue; and deteriorating refractory causing hot spots on the metal outer shell and a major loss of energy. Neither the chillers nor the boilers can meet the current load requirements of Building 350 and 351 because of their deteriorated state.

IMPACT OF DELAY:
A delay of this project would allow the existing roof to degrade to failure, putting the weather integrity of the structure at risk. The future cost to repair would then be significantly higher. Progressively higher water intrusion rates would also risk damage to indoor mainframe computers as well as to the interior of the building. The high frequency and excessive cost of maintenance would continue to increase. The chillers and the boilers are in such state of deterioration that they are likely to fail at any time in the near future. A failure of one of the chillers would create costly lost time disruptions due to the loss of necessary cooling capacity required to support both personal and mainframe computer usage in Building 350. Likewise, a failure of either one of the boilers would result in closure of Building 350 due to lack of building heat, or closure of the cafeteria operations in Building 351 due to loss of hot water.

PROJECT TITLE: Repair Storm Drainage System, Phase 1 Facility
INSTALLATION: Wallops Flight
COGNIZANT OFFICE: Office of Earth Science
LOCATION: Wallops Island, VA

FY 01 COST ESTIMATE (Thousands of Dollars)	2,700
Project Element:	
Clean, repair and line storm sewer	2,700

PRIOR YEARS FUNDING:	14,286
Construction	---
Facility Planning and Design	125
Capitalized Investment	14,161

PROJECT DESCRIPTION:
This project provides for replacing, lining and joint grouting 6,600 feet (2,000 meters) of the 50-year-old storm drainage piping system. The pipe sizes vary from 12 inches to 60 inches (305 millimeters to 1525 millimeters). The repair of associated catch basins and manholes is also included. Approximately $4.5 million will be required to repair the remaining segments of the storm drainage system.

PROJECT JUSTIFICATION:
This work is required to repair deteriorated storm drains located in an area with a high water table. The storm drainage system is 50 years old and eroding at the pipe joints. Video inspection of the interior of storm drainage pipes has revealed evidence of extensive cracking and failing pipes. In 1999, the failure of one of the deteriorated storm pipes located under Runway 10/28 caused erosion of the subgrade material around the pipe. This led to an almost immediate differential settlement of the runway pavement resulting in a large depression in the surface that imperiled aircraft operations. The work must be accomplished to prevent additional system deterioration that would undermine roads, taxiways and runways, thereby increasing the threat to personnel safety, aircraft and facilities.

IMPACT OF DELAY:
Delaying the rehabilitation of remaining pipes perpetuates the increasingly unacceptable risk of future failures, which could endanger aircraft and flight personnel.

PROJECT TITLE: Minor Revitalization and Construction of Facilities, Not in Excess of $1,500,000 Per Project
COGNIZANT OFFICE: Office of Management Systems LOCATION: Various

	Mission Support	Human Space Flight
FY 01 COST ESTIMATE (Thousands of Dollars)	106,800	9,400
Location:		
Ames Research Center	10,225	
Dryden Flight Research Center	4,900	
Glenn Research Center	7,825	
Goddard Space Flight Center	7,050	
Jet Propulsion Laboratory	11,050	
Johnson Space Center	22,400	1,200
Kennedy Space Center	14,200	6,800
Langley Research Center	7,100	
Marshall Space Flight Center	10,850	
Stennis Space Center	11,200	1,400

PROGRAM DESCRIPTION:
Proposed projects for FY 2001 are identified under "MINOR PROJECT COST ESTIMATE". They include Mission Support projects totaling $106.8 million for components of the basic infrastructure and institutional facilities, and $9.4 million to accomplish specific Human Space Flight projects. The $9.4 million is included in the appropriate budget line items of the Human Space Flight appropriation. The cost estimates are shown here to provide a complete picture of NASA's budget requirement for facilities.

These resources provide for revitalization and construction of facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. The request includes facility revitalization and construction needs for FY 2001 that are greater than $500 thousand but not in excess of $1.5 million per project. Revitalization projects provide for the repair, modernization, and/or upgrade of facilities and collateral equipment. Repair and modernization projects restore facilities and components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. Repair and modernization work includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown. It also includes major preventive measures that are normally accomplished on a cyclic schedule. Upgrade projects may include not only some restoration of current functional capability, but also enhancement of the condition of a facility so that it can more effectively accomplish its designated purpose or increase its functional capability. Occasionally minor facility construction projects will be required to provide for either the construction of small new facilities or additions to existing facilities. The facilities being revitalized or constructed in this program are expected to

remain active in the long term and are consistent with current and anticipated Agency roles and missions. Annual funding will be required for continuing minor revitalization and construction needs.

This program includes revitalization and construction projects estimated to cost more than $500 thousand per project. Projects $500 thousand and less in magnitude are normally accomplished by routine day-to-day facility maintenance and repair activities provided for in Human Space Flight; Science, Aeronautics and Technology; and Mission Support appropriations. Projects estimated to cost more than $1.5 million are included as separate discrete projects in the budget request.

PROGRAM JUSTIFICATION:

NASA is experiencing "block obsolescence" because 90% of the agency's facilities have been in use for over 25 years. Repair costs for mechanical and electrical systems in a typical building are almost three times higher after system operations exceed 15-20 years than they are during the initial years. Many electrical and mechanical components reach the end of their serviceable or economic life at the 20-year point and should be replaced. Continued piecemeal repair of these components is more costly in the long run than replacement at the end of the economic life of the original components.

The NASA physical plant has a capital investment of $6 billion and has a current replacement value of more than $20 billion. A continuing program of revitalization of these facilities is required to accomplish the following:

a. Protect the capital investment in these facilities by minimizing the cumulative effects of wear and deterioration.
b. Ensure that these facilities are continuously available and that they operate at peak efficiency.
c. Improve the capabilities and usefulness of these facilities and thereby mitigate the effects of obsolescence.
d. Provide a better and safer environment for all personnel.
e. Reduce current operating costs and avoid significantly greater future repair costs.

New construction will primarily replace substandard facilities in cases where it is more economical to demolish and rebuild than it is to restore. Included are projects that replace old and dilapidated railroad box cars, trailers, and other modular facilities that do not meet current occupational health and safety standards, and which no longer satisfy user functional requirements. In selected cases, additional square footage may be built when there are compelling reasons to support specialized requirements of a nature that cannot be provided for using existing facilities. Included in this latter category are technical, programmatic, and institutional projects that are essential to the accomplishment of an installation's mission objectives.

MINOR PROJECT COST ESTIMATE (Thousands of Dollars):

The projects that comprise this request are of the highest priority based on relative urgency and expected return on investment. Deferral of this mission-essential work would adversely impact the availability of critical facilities and program schedules. The titles of the projects are designed to identify the primary intent of each project and may not always capture the entire scope or description of each project. Also, during the year, some rearrangement of priorities may be necessary which may force a change in some of the items to be accomplished. Any such changes, however, will be accomplished within total the resources available.

HUMAN SPACE FLIGHT	9,400
A. Johnson Space Center (JSC)	1,200
1. Replace Roof, Building 150, Palmdale, CA	1,200
B. Kennedy Space Center (KSC)	6,800
1. Rehabilitate High Pressure Distribution Piping System, LC-39A	1,500
2. Rehabilitate High Pressure Distribution Piping System, LC-39B	1,500
3. Restore Low Voltage Power System, LC-39A, Phase I	1,500
4. Restore Low Voltage Power System, LC-39B, Phase I	1,500
5. Repair and Modernize HVAC and Emergency Exhaust System, Spacecraft Assembly Encapsulation Facility, Building M7-1210	800
C. Stennis Space Center (SSC)	1,400
1. Repair and Modernize Space Shuttle Main Engine A-2 Test Stand, Phase 2	1,400
MISSION SUPPORT	106,800
A. Ames Research Center (ARC)	10,225
1. Replace Transformer T-44	1,400
2. Repair Variable Pitch Mechanism Splines, National Full-scale Aerodynamics Complex (NFAC) [N221]	1,500
3. Replace Arc Jet Pumps and Electric Motors	1,400
4. Modify Building 19 for Seismic and Fire Safety	1,400
5. Rehabilitate and Modify 20 Megawatt DC Power Supply, Phase III [N234/238]	800
6. Rehabilitate and Modify N227 for Fire Suppression/Alarm Systems	650
7. Add No-Load Break Switches, National Full-scale Aerodynamics Complex [N221] and Unitary Plan Wind Tunnel (N227)	1,000
8. Modify N221 for Exit Stairway and N213 for Basement Exit for Safety Egress	1,000
9. Fire Protection Egress Modifications and Crane Upgrades, Various Facilities	1,075
B. Dryden Flight Research Center (DFRF)	4,900
1. Rehabilitate and Modify Flight Loads Laboratory	1,400
2. Life Safety Repairs, 12.47KV System	950
3. Rehabilitate and Modify Fire Alarm & Suppression, Various Buildings	1,450
4. Rehabilitate and Modify Ductbank Infrastructure	1,100

C. Glenn Research Center (GRC)	7,825
1. Replace CO2 Tanks & Repair High Pressure Steam Lines, Various Buildings	1,125
2. Repair Basement Slab, Space Power Facility Test Building 1411, Plum Brook Station (PBS)	1,400
3. Rehabilitate Model Fabrication and Instrument Facility (14)	900
4. Repair Natural Gas System	700
5. Repair Underpass Road Bridges	700
6. Rehabilitate Main Cafeteria (15)	700
7. Rehabilitate Clean Rooms, Instrument Research Laboratory (77)	1,400
8. Rehabilitate Cell 31, Research Combustion Laboratory (35)	900
D. Goddard Space Flight Center (GSFC)	7,050
1. Rehabilitate Heating, Ventilation, and Air Conditioning (HVAC) Systems, Building 23	800
2. Consolidate and Upgrade Instrument Technology Center Laboratories, Various Buildings	700
3. Repair Roofs, Various Buildings	1,450
4. Replace Power Panels, Building 4, 5, 7, and 10	550
5. Repair Electrical Rooms 1 & 2 and Replace Load Center Building 26	900
6. Modify HVAC Systems, Various Buildings, WFF	700
7. Modify Multi-Payload Processing Facility [F7], WFF	930
8. Replace Roofs, Building 3, 22, 25, and 29, WFF	1,020
E. Jet Propulsion Laboratory (JPL)	11,050
1. Upgrade Dynamics Test Facility, Environmental Test Laboratory	1,200
2. Upgrade Thermal Vacuum Chamber Controls, Building 144	850
3. Modifications to Applied Mechanics Facility [157]	750
4. Upgrade HVAC Controls, Various Buildings	850
5. Modifications for Logistics and Technical Information, Building 111	800
6. Upgrade Electrical Bank #7	850
7. Replace Generator Switchgear, Building 230	950
8. Modify Fire Alarm System, Various Buildings, Phase V	1,000
9. Upgrade Hydraulic Drive, 26M Antenna, Madrid, Spain	900
10. Refurbish Elevators, Various Buildings	1,100
11. Install Fiber Optic Fire Alarm and Security Communications System	900
12. Modification of Building 111, Southeast Basement	900

F. Johnson Space Center (JSC)	22,400
1. Replace Switchgear and Transformers, Buildings 11 and 35	900
2. Replace Switchgear and Transformers, Building 49	900
3. Replace Switchgear and Transformers, Buildings 7A and 15	900
4. Replace Switchgear and Transformers, Buildings 3 and 422	900
5. Rehabilitate Electrical Distribution System, Various Buildings	1,300
6. Repair Window Ledge Coverings, Various Buildings	900
7. Repairs to Propulsion Test Area Systems, WSTF	600
8. Replace 12KV Switches, Various Facilities	1,200
9. Repair and Upgrade Building Systems, Various Facilities [200 Area], WSTF	1,100
10. Repair and Upgrade Building Systems, Various Facilities [800 Area] WSTF	900
11. Safety Repairs to Street and Parking Lot Lighting System, Phase 2	1,300
12. Repair Low Voltage Panels, Mission Critical Buildings [24 & 30]	1,200
13. Install Electrical Grounding System, Various Buildings, Mall Area	1,500
14. Install Electrical Grounding System, Various Buildings, Remote Locations	500
15. Upgrade Electrical Power and Lighting Panels, Various Buildings	1,400
16. Replace Electrical Lighting Panels, Various Buildings	1,200
17. Repair Electrical Receptacle Panels, Various Buildings	1,300
18. Reconfigure Electrical Panel Circuitry, Various Area	1,100
19. Replace Electrical Bus Systems, Various Buildings	700
20. Replace Uninterruptible Power Supply Batteries, Various Areas	1,250
21. Rehabilitate Fire Protection System, Various Locations, WSTF	1,350
G. Kennedy Space Center (KSC)	14,200
1. Revitalize Electrical Power Distribution System, Industrial Area	1,000
2. Revitalize Secondary Power Systems, Vehicle Assembly Building, Phase 1	600
3. Revitalize Secondary Power Systems, LC-39 Area, Phase 3	900
4. Construct Replacement Housing for Pad A LOX/LH2 Operations Personnel	800
5. Construct Replacement Housing for Orbiter Processing Facility Hazardous Operations Personnel	1,500
6. Repair M7-505 HVAC and Roof, Phase 4	800
7. Replace Vacuum Circuit Reclosers and 15 KV Feeder 606, Phase 2	1,000
8. Repair and Upgrade Lighting and Fire Alarm Systems, Launch Control Center, Phase 2	1,300
9. Install Fall Protection Safety Devices, Various Facilities, LC-39 Area, Phase 3	1,400
10. Upgrade Emergency Lighting Systems, Various Facilities, LC-39 Area	800
11. Install Automatic Fire Sprinkler System, Various Locations, LC-39 Area	1,200
12. Upgrade Central Control Station Fire Monitoring System	1,500

13. Install Pier Scour Protection, Haulover Bridge	500
14. Upgrade Physical Security Countermeasures, Launch Pad 39B	900
H. Langley Research Center (LaRC)	7,100
1. Automation Modifications to 31-inch Mach 10 Tunnel (1251A)	1,400
2. Upgrade Transonic Dynamics Tunnel for Productivity Improvements (648)	1,425
3. Construct Integrated Test Facility	1,425
4. Modifications to 15-inch Mach 6 High Temperature Tunnel (1251A)	1,425
5. Rehabilitate Information Media Center (1152)	1,425
I. Marshall Space Flight Center (MSFC)	10,850
1. Repair and Modernize Electrical and Mechanical Systems [4619], Phase 2	1,500
2. Modifications for Composite Development and Manufacturing Laboratory [4707]	900
3. Repair and Modernize Fire Alarm System, Various Buildings, Phase 2	800
4. Rehabilitate and Modify Utilities Control System	1,350
5. Modifications to High Pressure Flammability Test Cells [4623]	800
6. Electrical and Mechanical Repairs to Buildings 4207, 4567, and 4755	750
7. Replace Elevators, Buildings 4708 and 4755	650
8. Repair Corroded Steel Structures, Various Test Stands	1,000
9. Safety Modifications to Overhead Cranes	500
10. Repairs to Cell P [131], Michoud Assembly Facility (MAF)	1,300
11. Repair Sprinkler Heads [103] MAF	1,300
J. Stennis Space Center (SSC)	11,200
1. Increase Capacity, Sewage Treatment Lagoons	550
2. Repair and Modernize Fire Alarm System, Various Facilities	1,450
3. Repair Pavements, Various Locations	1,100
4. Repair and Modify HVAC System, Environmental Laboratory Building [B-1105 West]	1,100
5. Repairs to Chilled and Hot Water Systems, B-Complex	800
6. Repair and Modify 13.8KV Underground Feeders	800
7. Repair and Modernize Interior Building Systems, Data Acquisition Facility [4995]	700
8. Repair and Modernize Secondary Power Systems, Various Facilities, Phase 2	700
9. Modify Propulsion Test and Support Facilities, E-Complex, Phase 1	800
10. Repair Cryo and High Pressure Fluid Components, Engine Test Complex	500
11. Repairs to Structural and Mechanical Systems, A-1 and B-2 Test Stands, Phase 1	1,200
12. Refurbish High Pressure Water Pump Diesel Engines [B-4400]	1,500

PROJECT TITLE: Facility Planning and Design
COGNIZANT OFFICE: Office of Management Systems LOCATION: Various

FY 01 COST ESTIMATE (Thousands of Dollars)	15,700
Project Elements:	
Master Planning	400
Sustaining Engineering Support	1,000
Project Planning and Design Activities	14,300

These funds are required to provide for advance planning and design activities; special engineering studies; facility engineering research; preliminary engineering efforts required to initiate design-build projects; preparation of final designs, construction plans, specifications, and associated cost estimates; and participation in facilities related professional engineering associations and organizations as follows:

A. Master Planning 400

The NASA field installation master plans need to be periodically updated. The master plans are essential as reference documents for land use planning, identification of physical relationships of facilities, and proper orientation and arrangement of facilities. The updates reflect as-built condition of facilities and utility systems with emphasis on changes caused by recent facility construction and modifications.

B. Sustaining Engineering Support 1,000

Provisions for facility studies and specific engineering support continue in importance as evidenced in recent years. These efforts are important due to changing trends in construction equipment, materials, and fuels; the operation and maintenance costs for the physical plant; and energy conservation and efficiency. The following items are included:

1. Value Engineering, and Design and Construction Management Studies

Provides for critically important studies to improve the quality and cost effectiveness of NASA's facility components and construction practices, and to ensure that developing technology and industry best practices are incorporated into the agency's construction program. Also provides services necessary to predict and validate facility costs to aid in resources planning and studies to assess design and construction functional management.

2. Facility Operation and Maintenance Studies

Provides for studies and engineering support, where not otherwise provided for, at NASA field installations relative to functional management of maintenance, automated maintenance management systems, and facilities condition assessments. Included in this activity are field surveys to be conducted at selected NASA field installations to evaluate the effectiveness and efficiency of the operations and maintenance management activities, and to identify possible improvements in productivity.

3. Facilities Utilization Analyses

Provides for the analyses of agencywide facilities utilization data covering (1) office and other types of building space; (2) designated major technical facilities; and (3) special studies comparing the utilization of technical facilities which are similar in type or capability, such as wind tunnels. Such analyses provide for (1) insights into and development of better methods of identifying

underutilized facilities; (2) improved techniques to quantify level of facilities use; (3) actions to improve facilities utilization; and (4) recommendations regarding consolidation/closure of Agency facilities.

4. Facilities Management Systems

Provides for continued engineering support for the technical updating of NASA's master text construction specifications to reflect the use of new materials, state-of-the-art construction techniques and current references to building codes and safety standards. Also provides engineering support for the Major Facilities Inventory, the Real Property Database and the Facilities Utilization Database systems.

5. Capital Leveraging Research Activities

Provides for modest participation in facilities related professional engineering associations, institutes, and organizations established to bring together major facility owners, contractors, and academia in proven research and study efforts to improve the quality and cost effectiveness of facilities engineering management practices for member organizations. Such organizations include, but are not limited to the Federal Facilities Council of the National Research Council, National Institute of Building Sciences, and the Construction Industry Institute. This also provides for independent research activities to address facility problems unique to NASA.

C. Project Planning and Design Activities 14,300

These resources provide for project planning and design activities associated with Mission Support construction projects. Project planning and design activities for construction projects required to conduct specific Human Space Flight or Science, Aeronautics, and Technology programs or projects are included in the appropriate budget line item.

1. Preliminary Engineering (700)

This estimate provides for preparation of Preliminary Engineering Reports (PERs), investigations, project studies and other pre-project planning activities related to proposed facility projects. Construction of Facilities programs. These reports are required to permit the early and timely development of the most suitable project to meet the stated programmatic and functional needs. Reports provide basic data, cost estimates and schedules relating to future budgetary proposals.

2. Related Special Engineering Support (2,500)

This estimate provides for investigations and project studies related to proposed facility projects to be included in the subsequent Construction of Facilities programs. Such studies involve documentation and validation of 'as-built' conditions, survey/study of present condition of such items as roofing and cooling towers, utility plant condition and operational modes, and other similar field investigations and studies. These studies are required to support long term project development strategies, and project specific designs, cost estimates, and schedules.

3. Design (11,100)

The amount requested will provide for the preparation of designs, plans, drawings, and specifications necessary for the accomplishment of construction projects. Also provides technical and engineering support analyses, designs, and reviews required to verify, confirm and ensure suitability of construction designs within the project cost estimates. This work is associated with construction proposed for the FY 2003 program and with changes to projects proposed for the FY 2002 program. The goal is to obtain better facilities on line earlier at a lower cost.

Total Facility Planning and Design 15,700

PROJECT TITLE: Environmental Compliance and Restoration Program
COGNIZANT OFFICE: Office of Management Systems, Environmental Management Division LOCATION: Various Locations

FY 2001 Cost Estimate (Thousands of Dollars)	41,000
Location:	
Ames Research Center	720
Dryden Flight Research Center	600
Glenn Research Center	3,895
Goddard Space Flight Center	540
Jet Propulsion Laboratory	3,010
Johnson Space Center	1,060
Kennedy Space Center	9,000
Langley Research Center	140
Marshall Space Flight Center	8,000
Michoud Assembly Facility	1,200
Stennis Space Center	4,800
Wallops Flight Facility	1,610
White Sands Test Flight Facility	4,300
Headquarters	2,125

PROGRAM DESCRIPTION:
The Program provides for environmental activities necessary for compliance with environmental requirements including environmental program initiatives. Proposed environmental activities for FY 2001 are identified below under "ENVIRONMENTAL ACTIVITIES COST ESTIMATE" title. The Program includes activities necessary for NASA to comply with environmental statutory and regulatory requirements and standards, orders, regulatory and cooperative agreements, and support of environmental program initiatives. The Program focuses our efforts in the principal areas of environmental compliance, remediation, conservation, pollution prevention and closures. Within this framework, compliance with environmental requirements is performed, while simultaneously remediating previously contaminated sites, performing environmental closures, and promoting the identification of pollution prevention and conservation activities. The resources authorized and appropriated pursuant to this Program may not be applied to other activities. Program activities include projects, studies, assessments, investigations, plans, designs, related engineering, program support, and sampling, monitoring, and operation of remedial treatment processes as part of the remediation and cleanup measures. These activities will be performed at NASA installations, NASA-owned industrial plants supporting NASA activities, and other current or former NASA sites where NASA operations have contributed to environmental problems and NASA is obligated to contribute to cleanup costs. In addition, these resources will be used to provide for regulatory agency oversight costs, to acquire land if necessary to implement environmental compliance and restoration measures, and to perform studies, assessments and other activities in support of functional leadership initiatives related to the environmental program.

PROGRAM JUSTIFICATION:

The Program represents this year's request on a phased approach in relation to the total Agency requirements for environmental remediation measures that must be implemented within the next several years, as well as for needed requirements for other environmental compliance measures. The Program includes activities necessary for compliance with environmental statutory and regulatory requirements and standards, orders, regulatory and cooperative agreements, and support of environmental program initiatives. Based on relative urgency and potential health hazards and safety, these activities are the highest priority requirements currently planned for accomplishment in FY 2001. Deferral of these necessary compliance and remedial measures would preclude NASA from complying with environmental requirements and regulatory agreements, and jeopardize NASA operations. As studies, assessments, investigations, plans, regulatory approvals, and designs progress and as new discoveries or regulatory requirements change, it is expected that priorities may change and revisions to these activities may be necessary.

The broad environmental categories summarizing the efforts proposed to be undertaken with the identified estimated costs are listed below. Remediation activities include one or more phases of a site cleanup program from site identification to final closeout, including but not limited to site assessments, site investigations, interim cleanup actions, testing and evaluation, remedial treatment systems and processes, monitoring, and other activities associated with CERCLA/RCRA cleanup requirements.

a. Environmental Remediation Activities and Initiatives --- Remediation (e.g. CERCLA, RCRA) .....$ 34,510
b. Other Environmental Compliance Requirements and Initiatives ---
   Compliance, Restoration, Prevention, Closures (e.g. CAA, CWA, RCRA, ESA, AEA, PPA) .....$ 6,490

CERCLA = Comprehensive Environmental Response, Compensation and Liability Act
RCRA = Resource Conservation and Recovery Act
CAA = Clean Air Act
CWA = Clean Water Act
ESA = Endangered Species Act
AEA = Atomic Energy Act
PPA = Pollution Prevention Act

ENVIRONMENTAL ACTIVITIES COST ESTIMATE (Thousands of Dollars):
The activities that comprise this request are as listed below by location.

A. Ames Research Center (ARC)	250
1. Remediation of Area of Investigation 5 – (Solvents)	250
B. Dryden Flight Research Center (DFRF)	600
1. Remediation of Soil/Groundwater Contamination	600
C. Glenn Research Center (GRC)	3,340
1. Remediation Activities at Operable Unit, (PBS)	225
2. Remediation of Contaminated Areas	500
3. Sewer System Compliance Modifications, Various Locations	600
4. Plum Brook Reactor Decommissioning Planning Activities	2,015
D. Goddard Space Flight Center (GSFC)	200
1. Remediation of Landfills (4)	200
E. Johnson Space Center (JSC)	800
1. Environmental Assessment/ Cleanup, NIP, Downey	150
2. Remediation of Monitoring Well #2 Area	400
3. Closure of Oil/Water Treatment System, Ellington Field	250
F. Kennedy Space Center (KSC)	5,000
1. Remediation at Launch Complex 34 (CCAS) Site, Interim Action	700
2. Remediation at Hydrocarbon Burn Facility Site	1,000
3. Remediation at Wilsons Corner Site, Phase 2	200
4. Remediation at MLP Rehabilitation Site	1,000
5. Remediation at Crawler Park (East) Site	400
6. Remediation at Fuel Storage Area 1 (CCAS) Site, Interim Action	700
7. Restoration of Wetlands and Scrub Habitat	300
8. Various Interim Measures, Various Locations (KSC and CCAS)	700

G. Marshall Space Flight Center (MSFC)	6,900
1. CERCLA Investigation and Cleanup	5,700
2. RCRA Investigation and Cleanup, Santa Susana Field Laboratory	500
3. Sewer System Rerouting and Compliance Modifications, Phase 2	700
H. Michoud Assembly Facility (MAF)	1,150
1. Remediation Activities, Various Locations	1,150
I. Stennis Space Center (SSC)	4,100
1. Remediation Activities at Various Sites, Areas H & I	4,100
J. Wallops Flight Facility (WFF)	1,300
1. Remediation of Contaminated Sites (4)	1,300
K. White Sands Test Facility (WSTF)	4,300
1. Groundwater Contamination Assessment and Remediation	4,300
L. Studies, Assessments, and Investigations; Plans; Designs; Sampling, Monitoring and Operation of Remedial Treatment Systems; Related Engineering and Program Support, Various Locations	13,060
Total Environmental Compliance and Restoration Program	41,000